

REMARKS/ARGUMENTS

This Amendment, and the enclosed Petition For Extension of Time, are Applicants' "submission" under Patent Office Rule 114 accompanying the Request for Continued Examination submitted herewith.

Claims 1-15, which were subject to restriction, have now been canceled, without prejudice to the presentation of such claims within a divisional patent application claiming the benefit of the May 19, 2000 filing date of the present application.

Claims 16-22 are still pending for examination; claim 16 has been amended above. New claims 23 and 24 have been added to the present application.

Thus, the claims now pending for examination are claims 16-24. Continued examination of this application, and reconsideration of the prior rejection of claims 16-22, is respectfully requested in view of the foregoing claim amendments, and in view of the following remarks.

Within Paragraphs 1 and 2 of the Office Action, the Examiner rejected claim 16 under 35 U.S.C. §112, first paragraph; the Examiner contends that Applicants did not originally disclose "the solder bar or the mass of the solder bar being made of a low melting temperature reflowable solder". By amendment above, the offending language has been stricken from claim 16. Applicants' original disclosure, at page 1, line 27, describes a "63 Sn/37 Pb flip chip solder bump." Within the final Office Action mailed on July 30, 2003, the Examiner concedes that Applicants' "specification (pages 1-11) discloses the solder being tin/lead eutectic composition solder." Claim 16 has been amended to identify the recited solder mass of sub-paragraph (d) as a mass of tin/lead eutectic composition solder.

Accordingly, Applicants submit that claim 16, as amended, does not recite any subject matter that was not disclosed within Applicants' specification as originally filed. Consequently, Applicants request that the Examiner withdraw the rejection of claim 16 under 35 U.S.C. §112,

first paragraph.

Within the Office Action, the Examiner rejected pending claims 16-22 under Section 103 as describing subject matter considered to be obvious from U.S. Patent No. 4,605,153 ("Van Den Brekel") in view of U.S. Patent No. 5,453,582 ("Amano") and U.S. Patent No. 5,796,169 ("Dockerty").

Unlike the present invention, Van Den Brekel is not really concerned with flip chip attachment, but is instead directed to the formation of solder pads used to support and attach the cylindrical ends of discrete resistors and capacitors on a PC board. The solder pads are "shaped" to provide two "humps". To create such "humps", the thickness of the applied solder paste is increased in such regions, as by applying two humps of solder paste. The Van Den Brekel specification states that, when heated, the two solder humps join each other but maintain their humped shapes when molten. The discrete device is then placed on the PC board between the "humps", and the PC board is reheated to attach such discrete components to the PC board. The Examiner contends that Van Den Brekel discloses the subject matter claimed by Applicants except for 1) circular solder pad end points; and 2) the height H1 of the solder at the end points being approximately equal to the height H2 of the solder mass midway between the end points.

The newly-cited Amano patent relates to a circuit board or other substrate having solder layers arranged in strips or bars. Each of these strips or bars includes a widened end portion that is not used for mounting components and a narrower central region that is used to mount components. For example, in Fig. 5D, elongated solder pad 2 has two enlarged circular end regions 2B/2C and a narrower central region 2A. Central region 2A is described as a component mounting portion, while end regions 2B/2C are described as component lead non-mounting portions. It seems reasonably clear from Fig. 2 that the solder height at end region 2C is much greater than the solder height in central region 2A. The Examiner relies upon Amano as teaching the desirability of making the end regions circular and of greater diameter than the

narrower central region.

As shown in Fig. 2 of Amano, Amano teaches that the height of the solder 3 at enlarged end points 2C is much taller than above central region 2A, whereas Applicants' pending claim 16 requires that the solder height H1 at the end points be approximately equal to the solder height H2 in the central region of the solder bar. Thus, the teaching of Amano is directly contrary to the subject matter claimed by Applicants.

The Examiner apparently recognizes that Amano's solder mass is of non-uniform height; for this reason, the Examiner also relies upon the previously-cited Dockerty patent, arguing that Dockerty teaches the desirability of making the solder height uniform from one end point to the opposite end point of the solder bar. The Examiner now argues that it would have been obvious to make Van Den Brekel's humps of solder with circular end point solder pads of enlarged diameter (per Amano) but having a uniform solder height (per Dockerty), and that such a combination would provide the solder bar recited by Applicant's claim 16.

Claim 16 recites a reflowable solder bar that includes, *inter alia*, first and second generally circular solder pads each of diameter D; a solder bar pad of bar width BW connecting the first and second circular solder pads wherein bar width BW is less than diameter D; and a mass of tin/lead eutectic composition solder formed over the first and second generally circular solder pads and over the solder bar pad, the solder mass reaching a height H1 above the centers of the first and second generally circular solder pads, and reaching a height H2 above the midpoint of the solder bar pad, and wherein heights H1 and H2 are approximately equal.

On the one hand, Dockerty teaches those skilled in the art to maintain the end-point diameters equal to the solder bar width in order to achieve uniform height. Indeed, Dockerty stresses the importance of matching the cross-section of the support solder (at least along one axis) to the cross-section of the solder balls; see, for example, col. 2, lines 18-22; col. 2, lines 32-36; col. 2, lines 48-51; and particularly, col. 2, lines 54-59. On the other hand, Amano

teaches those skilled in the art that making the end point diameters larger than the solder bar width ensures that the solder height at the end points will be taller than the solder height at the midpoint. How then could it be "obvious" to those skilled in the art, based upon such references, to make the end point diameters D greater than the solder bar width BW and still achieve a substantially uniform solder height (H1/H2) across the entire solder bar? Dockerty teaches that uniform height requires the end point diameters to be equal to the bar width; Amano teaches that making the end point diameters greater than the bar width results in greater solder height at the end points. Thus, both Dockerty and Amano teach away from making the end point diameters (D) larger than the bar width (BW) in the case where uniform solder height is desired. Accordingly, even if the teachings of Dockerty and Amano were combined with the cited Van Den Brekel patent, it could not be obvious from such references to make the end point diameters greater than the bar width and still end up with uniform solder height.

For the reasons set forth above, claims 16-22 define subject matter that would not have been obvious to those skilled in the art based upon the art cited by the Examiner.


New claims 23 and 24 have been added to the present application. Claim 23 is similar to amended claim 16 except that the solder mass of claim 23 is not limited to tin/lead eutectic composition solder. Claim 24 depends from claim 23 but recites that the solder mass is a eutectic solder. Applicants submit that claims 23 and 24 are allowable for the same reasons set forth above relative to claim 16.

Applicants respectfully submit that the present application is now in condition for allowance, which action is earnestly solicited.

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Respectfully submitted,

CAHILL, von HELLENS & GLAZER, P.L.C.


Marvin A. Glazer
Registration No. 28,801

155 Park One
2141 East Highland Avenue
Phoenix, Arizona 85016
Ph. (602) 956-7000
Fax (602) 495-9475